# Use of Carotid Intima-Media Thickness and Plaque Volume to predict single or multi-vessel Coronary Artery Disease.

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## Introduction

Globally 48% of deaths are linked to cardiovascular (CV) disease of which 45% are due to ischaemic heart disease.

Invasive coronary angiography (ICA) or non-invasive CT coronary angiography (CTCA) have high sensitivity and specificity for detection of obstructive coronary artery disease (CAD). It has been reported that around 1/3 of patients undergoing ICA are found not to have obstructive CAD. Yet, both ICA and CTCA are costly and not without clinical risk (including radiation and contrast).

Carotid intima-media thickness (cIMT) and carotid plaques have been described as surrogate biomarkers of subclinical atherosclerosis. Measurement of cIMT through B-Mode ultrasound is non-invasive, inexpensive and straightforward to perform.

## Objectives

Although cIMT is used as a surrogate marker for CV risk it has not been established as a diagnostic tool for prediction of CAD.

The primary aim of this study is to establish whether cIMT measurement can predict the presence and severity of CAD as defined by ICA or CTCA.

## Methods

Patients were recruited with a history of ischaemic-type chest pain or angina equivalent who were undergoing ICA or CTCA.

All patients underwent high-resolution B-mode ultrasound imaging using latest generation dedicated hardware and software to measure cIMT and B-Mode 3D-imaging to measure Total Plaque Volume (TPV) and Maximum Area Reduction (MAR). The operator was blinded to the results of the ICA or CTCA.

cIMT measurements were taken from the far vessel wall, 1 cm proximal to the carotid bifurcation or the first available plaque free location. The measurement was taken at the peak of the R wave and the mean CIMT of three cardiac cycles was calculated.

cIMT percentile ranges were defined according to a previous independent large European population study. A second operator, blinded to carotid measurements, defined the presence and severity of CAD on ICA or CTCA.

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## Results

The study population comprised of 91 subjects (73% male). Mean age was 66.2±11.63SD years (range, 42-88 years). CV risks factors included family history of CAD (74%), current or ex-smoker (69%), hypertension (66%), a history of hyperlipidaemia (61%) and diabetes (21%).

On ICA or CTCA, 62% of patients had severe disease (defined as at least 70% area stenosis or pressure wire positive) in at least one coronary artery, and 39% had severe multivessel disease (in 2 or more vessels).

The presence of elevated cIMT ≥50th percentile predicted the likelihood of severe multivessel CAD (relative risk [RR] 1.49; 47% vs 21%; p=0.022) and the likelihood of severe CAD in at least one vessel (RR 1.65; 71% vs 43%; p=0.011).

Use of cIMT ≥75th percentile cut off did not increase predictive value.

On 3D analysis, TPV in the top tertile predicted likelihood of severe CAD in at least one vessel (RR 1.4; 77% vs 55%; p=0.046). MAR did not add further to the predictive value.

| | cIMT ≥50th percentile (n=62) | cIMT <50th percentile (n=28) | p value | cIMT ≥75th percentile (n=41) | cIMT <75th percentile (n=49) | p value |
|---|---|---|---|---|---|---|
| Severe CAD in ≥1 vessel | **44** | **12** | **0.011** | **31** | **25** | **0.016** |
| Severe CAD in 2+ vessel | **29** | **6** | **0.022** | **19** | **16** | **0.18** |

## Conclusions

In a population of patients with ischemic type chest pain or angina equivalent symptoms, elevated cIMT (≥50th percentile) predicted an increased risk of severe CAD in at least one vessel and over double the risk of severe multivessel CAD.

CIMT may therefore be a useful tool to help triage patients most likely to benefit from invasive coronary angiogram investigation.

Ongoing research in a larger cohort may be beneficial.

## References/Authors

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